CITY OF GREENSBORO STANDARDS
FOR
WATER AND SEWER DESIGN
UPDATED 11/01/01

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Design Requirements

I. GENERAL

A. Outside City Limits and Within Water and Sewer Service Boundary

1. Greensboro will accept new water and sewer mains only for developments within the water and sewer service boundary as shown on the map adopted by City of Greensboro City Council on August 21, 2001.
2. Single-family residential lots and non-residential principal buildings that were existing as of December 21, 1999 and are outside of the service boundary will be allowed to connect to water and/or sewer if the water and/or sewer currently abut the property. The connections will be limited to 1-1/2 inches for water and 4 inches for sewer.
3. Properties for which a valid Utility Agreement and Annexation Petition was recorded or a master plan, site plan or preliminary subdivision plan was approved as of December 21, 1999 will be eligible for water and sewer service.
4. Guilford County Schools within unincorporated areas are eligible for water and sewer service but must first be approved by the City of Greensboro and Guilford County.
5. "Doughnut hole" property surrounded by properties covered by previously submitted utility agreement and annexation petitions and located in an unincorporated area are eligible for service.
6. Properties within the Limited Availability Area shown on the map will be allowed connections to or extensions of existing underutilized lines until an additional 250,000 gallons per day of water consumption has been achieved.
7. Plans for projects outside the city limits, but within the service boundary, should be submitted to the Guilford County Planning Department. These plans will be forwarded to the City of Greensboro Planning Department for a preliminary review. Preliminary Plans with water and/or sewer main extensions require a North Carolina registered P.E. seal.
8. Once Preliminary Plans have been approved, 3 sets of construction drawings should be submitted to the City of Greensboro Engineering & Inspections Department.

B. Inside City Limits

1. Preliminary plans must first be submitted to the City of Greensboro Planning Department for review by the Technical Review Committee (TRC). Preliminary Plans with water and/or sewer main extensions require a North Carolina registered P.E. seal.
2. Once Preliminary Plans have been approved, 3 sets of construction drawings should be submitted to the City of Greensboro Engineering & Inspections Department.

C. Plan Format and Other Requirements

1. Construction plans should include:
   a. A location map showing property boundaries in relation to existing and proposed streets.
   b. An overall site plan clearly indicating existing and proposed utilities. This should include topography for the entire project.
   c. If the project is to be done in phases, include a master plan clearly indicating the phase(s) to be approved.
   d. Provide a plan and profile sheet for proposed mains. Lines which will be public (i.e., in public easements) must be on "City of Greensboro" mylar. Private lines shall not be drawn on "City of Greensboro" mylar.
   e. All plans should be stamped and signed by a Professional Engineer with a valid North Carolina license and denoted as "Preliminary" or "For Construction". The Engineer's address information shall be on the plan.
   f. No plan submitted should be larger than 24" x 42".
2. The City Engineering Division will provide mylar plans and profile. Scales shall be 1" = 40' horizontally and 1"= 4' vertically.
3. When all corrections have been made; two sets of plans, non-discharge permit application, water permit application, and necessary permit and inspection fees are to be submitted to the Water Resources Department for issuance of the State construction permits. Fees for internal inspection of public mains must also be paid prior to plans being stamped for construction. For projects where the sewers discharge to High Point or Jamestown the wastewater permit will need to be issued by the State. The permit number issued by the State will need to be forwarded to the City of Greensboro before plans will be stamped for construction.
4. When all state permits have been issued and all divisions have checked off, plans are to be submitted to the Engineering Division, for "Approved for Construction" stamping.
5. After the proposed plans have been approved by the City, but prior to the beginning of construction, the contractor shall notify the City Engineering Division (Inspection Section) at least 24 hours prior to the beginning of construction.
6. Plans resubmitted due to revisions shall have all revisions highlighted.
7. After construction of water and sewer improvements, a City Utility Inspector will request submittal of "as-built" drawings. The Design Engineer will forward two bound copies of signed and sealed "as-built" prints to the Engineering Department for review. These prints are forwarded to the Utility Inspector for on-site inspection and verification. If the prints are incorrect, the Design Engineer will be contacted and the prints will be returned for corrections. This process will continue until all comments have been addressed.
8. Upon completion and approval of "as-built" prints, the engineer shall supply the City Engineering Division with the original mylar corrected "as-built". "As-built" mylars must be provided to the City prior to any public line being accepted and placed in service. Future plans may not be reviewed until all mylars are received for previous jobs.
9. The City will internally inspect all public sanitary sewers, after receiving "as built" plans, for final acceptance.
10. Preliminary plans that are over one year old must be resubmitted for review. Approved construction plans, which are over eighteen (18) months old and construction has not started, must be resubmitted for review.
11. No lines will be placed in service until "as-built" drawings have been released and all required easements have been properly recorded and documented.
12. Questions concerning design, materials, or construction requirements should be directed to the Water Resources Department at 373-2055.

II. WATER

A. Design Requirements

1. Plans will be required on all water lines up to the building. City inspection will normally stop at the meter. However, if 3” or larger lines are used past the meter, inspection will continue to the building.
2. All unmetered waterlines 4" and larger shall be ductile iron. All unmetered lines 2" and 3" in size shall be Type "K" copper.
3. Materials used from the meter to a point a minimum of 2‘ past the backflow device shall be Type "K" copper for lines up to 3” and ductile iron for lines 4” and larger.
4. A backflow device is required on all non-residential services.
5. Materials on the property side of the meter and backflow device shall meet plumbing code requirements.
6. If meter is installed within street R/W, then backflow device shall be installed at the P/L outside of street R/W.
7. If meter is installed outside of street R/W, then backflow device shall be installed on the outlet side of the meter and within 10' of the meter.
8. Hydrant spacing for public water mains is a hydrant at each intersection with intermediate spacing not to exceed 500'.
9. Hydrant spacing for private on-site developments requires a hydrant to be within 500' of any portion of a building, as measured around that building. These distances would be measured the way fire hose would be laid or dropped from a driven fire truck. A fire hydrant is required within 150' of fire department connection. Any fire hydrants on property must be no closer than 40‘ from all buildings. If the present hydrant spacing at the street does not meet standard design criteria, the City may review the plan and install a hydrant at City expense. If the spacing meets the standard and a hydrant is still required at the street the owner will pay the expense. All hydrants shall have a guard valve.
10. All unmetered lines 3" and larger shall be chlorinated.
11. Minimum main size in non-residential areas shall be 8".
12. The City Engineering Division will inspect all sprinkler systems to the main cut off valve of the building.
13. Plan only is required on water mains up to and including 12”. Profile is required on water as constructed, if pipe cover deviates from 4' standard or if conflicts with other utilities arise. A profile is required on all water mains 16" and larger.
14. The Water Resources Department may require calculations of water flow and pressure.
15. Water mains shall be extended across the entire frontage of a property. Corner properties, which have water existing on one side, will be required to extend water on adjacent side.
16. The Water Resources Department may require loop feeds to ensure water quality.

B. Fire Sprinkler Connection Requirements

1. Show the City water line in its proper location and size.
2. Confirm that the requested sprinkler connection is no greater size than the City main.
3. Confirm that no fire pump is to be installed.
4. If a fire pump is involved, calculations will be submitted with plans to determine whether or not the starting or stopping of this pump will introduce undesirable system pressure. (Be especially cautious of pumps with capacities greater than 1,000 gpm at 50 psi.)
5. Each sprinkler connection must have a Siamese Connection that is readily available to the Fire Department. This Siamese Connection must be located within 150' of a fire hydrant located on the City main or the sprinkler main on the property. A check valve must be located between the Siamese Connection and the hydrant source. If an existing hydrant does not meet these requirements and if the hydrant spacing along the street is in conformance with our standard design criteria, then the additional hydrant shall be installed at the expense of the property owner. The Siamese Connection must be shown on the sprinkler plan before approval will be made.
6. All pipe installed in the street right-of-way, water line easement, or on private property must be ductile iron as per city specifications. If water main on private property is master metered, PVC may be substituted for ductile iron on portion past meter.
7. The tapping valve, sprinkler main valves, hydrant valves, and check valves must be shown on the site drawing.
8. There must be a backflow preventer installed per city standards on the sprinkler system. This backflow preventer must be installed on the property, outside the street right-of-way or water line easements. The backflow preventer can be installed inside the building if the domestic connection is within 10' of the building and no other dead-end fire line is proposed. The location of the backflow preventer must be shown on the plan. The following standards are established pertaining to the location and type of the backflow preventer on the sprinkler system:
    a. A double check assembly may be used on any fire sprinkler system where a health hazard does not exist.
    b. A reduced pressure backflow preventer is required on any fire sprinkler system where a potential health hazard may exist such as an anti-freeze solution or other chemicals that are introduced to the sprinkler system.
    c. All backflow preventers, including double check assemblies and reduced pressure backflow preventers must be installed to City of Greensboro standards.
    d. If a fire pump is installed on the sprinkler system, the backflow preventer must be installed on the suction or city side of the pump.
    e. If the domestic service line is not connected to the sprinkler line or if the domestic service is connected to the sprinkler line within the street right-of-way or easement, a backflow preventer must be installed at the property line. The location of the domestic service must be shown on the site drawing.
    f. If the backflow preventer is installed at a point on the property, the domestic service must be installed within 10'. The backflow preventer must-be installed on the building side of the domestic connection point. The location of the domestic service must be shown on the sprinkler site drawing.
    g. If changes or improvements are made to an existing sprinkler system, the entire system, including the existing portion, has to be brought up to these standards.
9. Utility construction plans must be approved prior to the installation of any fire sprinkler system. If a fire hydrant is required, a state water application must accompany the

plans for final approval. Submit 3 sets of the site drawing only to: City of Greensboro, Attn: Engineering Dept., P. 0. Box 3136, Greensboro, NC 27402-3136.

10. The contractor must call Engineering Inspections, at 373-2377, and must have a set of plans approved by the Water Resources Department before construction begins.
11. The contractor must pressure test line in the presence of City's Utility Inspector or show a certified statement of test results from Fire Underwriters.
12. Samples will be taken from all sprinkler lines up to the double check valve by the City's Utility Inspector. If samples are bad, then chlorination of that portion of line will be required. On lines where domestic water is connected, the line has to be chlorinated.
13. Before any valves are operated in the City right-of-way, the contractor must call the City Inspector.

III. SEWER

Design Requirements

1. All sewer design shall meet at a minimum, the design requirements of the NC Department of Environment and Natural Resources, Division of Environmental Management or the City of Greensboro Water Resources Department, whichever is more stringent.
2. Plan view should show: Manhole number or station; pipe material designation; manhole top elevation; drop manhole location; and building(s) with lateral location(s).
3. DIP is required where proposed cover is less than 4'. All lines which cross sanitary sewer should be shown on plan and profile. For depths greater than 20' and for grades 10% or greater, DIP is required. DIP is required for sewer lines in fill areas outside curb and gutter.
4. Maximum sewer main depth not to exceed 20' without prior approval by the Water Resources Department.
5. Whenever possible, sewer should be laid at least 10' horizontally from any existing or proposed water main. If this spacing is not possible, ductile iron pipe is required.
6. When sanitary sewer crosses storm sewer, allow 1' of vertical separation between pipes. If this cannot be met, ductile iron sanitary sewer, 10' each side of storm sewer will be required. For storm sewers 24" and larger, where clearance above sanitary sewer is less than 1', concrete piers on each side of sanitary sewer to support storm sewer will be required, in addition to ductile iron pipe.
7. Whenever it is necessary for a water main to cross above the sewer line and a vertical separation of 18 inches cannot be maintained, then the sewer line shall be ductile iron pipe 10' each side of the water line. Whenever a sewer line crosses above a water main, the sewer must be ductile iron pipe 10' each side of the water line.
8. Profile should show: existing and proposed ground elevation; location, depth and size of all lines which cross path of sanitary sewer; invert in and out elevations; locations where DIP or special structures are required.
9. A profile should be provided for any existing sewer line that will be affected by a project. Existing and proposed ground elevation should be shown.
10. Where applicable, the 100-year flood elevation should be shown on the sewer profile. Note how the 100-year elevation was determined and what vertical datum it references.
11. A line will be considered a main if more than one building is connected to it. Mains require manholes at all changes in line, grade and size. All public mains must be a minimum of 8" with a minimum slope of 0.5% (maximum slope 10% without prior approval). A private main can be 6" provided a 1% minimum grade is maintained. A 6" private main, with manholes, will be required in lieu of a 4" service where the lateral length is greater than 180'.
12. Mains extended in the street to serve a property must be extended across the entire frontage of the property. Projects, which require extension within a drainage basin, must be extended to the upper most point of the property or to any other point which can provide reasonable service to adjacent property or properties.
13. Sanitary sewer pipe may be R.C.P., V.C.P. or Ductile Iron (bituminous coated). PVC and PVC truss can be used only in residential use. The City of Greensboro Water Resources Department reserves the right to specify the pipe material based on system knowledge.
14. All pipe material, structures and construction methods shall meet the requirements of the City of Greensboro's standard specifications for sanitary sewers.

15. Manhole tops in areas, which can be flooded, or where indicated by the Water Resources Department shall have watertight covers.
16. All manholes should be located at least 30' from a creek bank. No place along the sewer line should be within 20' of a creek bank. Sewer should cross creeks at 90 degrees. Creek crossings should be minimized.
17. Maximum manhole spacing for public mains to be 500' for lines 15" in diameter or less and 600' for sewers 18" and larger or as directed by the Water Resources Department. Maximum manhole spacing for private mains to be 400'.
18. No more than a total of four incoming and/or outgoing lines will be allowed in any manhole. In some cases due to size and alignment, four lines will not be allowed. Angle of flow from incoming to outgoing line shall not be less than 90 degrees. A 0.1' drop should be provided through the manhole. For lines tying to existing outfalls, invert in should be at least in the upper third of the existing lines.
19. A drop manhole is required where difference between inverts in and out is greater than 2.0'. Outside drops are recommended unless the situation dictates an inside drop. Any inside drop manhole shall be at least 5' in diameter and must be approved by the Water Resources Department.
20. Maximum slope: 10% for 8" (may allow greater for short sections to avoid deep manholes or drops, DIP required).
21. Pipe on piers to be DIP (restrained joints) or steel (indicate steel wall thickness on plans).
22. Piers to be reinforced concrete, spacing of piers to be 18/20' or 36/40', expansion joints should be shown on long sections of pipe on piers.
23. A detail showing pier design should be included on plans along with pipe deflection calculations.
24. An individual lateral must be provided for each building. For townhouses, an individual lateral must be provided for each unit; all units in one building may be combined into a common 6" line (1% minimum slope). More than one building will require a main, which may be 6" if private.
25. Separate plumbing must be provided for the first and subsequent floors where the finished floor of the first level is lower than the rim elevation of the upstream manhole. A backwater valve must be provided on the first floor service to help eliminate the problem of flooding in case of a main stoppage.
26. All service laterals shall be service weight cast iron pipe, coated, or schedule 40 PVC with a one-way cleanout at the easement line, including those tied into manholes. Traffic bearing cleanouts will be required in all paved areas or where indicated by the Water Resources Department. All traffic-bearing cleanouts shall be Josam Model #56044 or approved equal. No services will be allowed on mains deeper than 15' unless specifically approved by the Water Resources Department. Whenever possible, laterals should be tied to the mainline.
27. Maximum service lateral depth not to exceed 12' without prior approval by the Water Resources Department.
28. Private lift stations shall not serve more than one property. Private lift stations are only allowed where gravity sewer exists adjacent to a property but is not deep enough to serve all of the property. Private lift stations may be allowed where an existing condition could present a health hazard. Private lift stations require specifications and detailed site plan for approval by the City of Greensboro and must be permitted by the State.
29. No private force mains are permitted in public right-of-way.
30. Public lift stations must meet established minimum standards. Public lift stations will only be approved on a case-by-case basis.
31. Temporary construction easements will be 40' unless otherwise indicated. These easements may vary depending on size, depth and project conditions. It is the

developers responsibility to obtain any easements which are required to extend water and sewer lines.

Water & Sewer Slope, Easement & Encasement Standards

Pipe Size	Minimum Slope	Permanent Easement Width*	Encasement Pipe Outside Diameter	Min. Wall Thickness for Rdwy. Crossing
8"	0.5%	20'	14	0.216
10"	0.3%	20'	16	0.250
12"	0.22%	20'	18	0.250
15"	0.15%	20'	20	0.250
18"		25'	24	0.250
21"		25'	30	0.312
24"		25'	30	0.375

*Additional easement will be required where the depth is greater than 10'.

11/1/2001 Revision